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(54) HEXABORIDE PARTICLE, DISPERSED BODY WITH DISPERSED HEXABORIDE PARTICLE AND ARTICLE USING HEXABORIDE PARTICLE OR DISPERSED BODY

(57)Abstract:

PROBLEM TO BE SOLVED: To provide hexaboride particles with improved water resistance, a dispersed body thereof and an article using the hexaboride particles or the dispersed body thereof.

SOLUTION: The hexaboride particles of one or more kinds of elements (X) selected from Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Sr and Ca or the dispersed body comprising the particles dispersed therein are characterized in having surfaces of the hexaboride particles physically coated with a surface treating agent containing silicon selected from a silazane treating agent, a chlorosilane treating agent, an inorganic treating agent with an alkoxy group in the molecular structure and an organic treating agent with an alkoxy group on the end or in the side chain of the molecule or coated with the surface treating agent chemically bonded to the hexaboride particles on the surfaces thereof.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, The dispersing element of 6 boride particle which distributed the compound particle (6 boride particle) and this 6 boride particle of one or more kinds of elements (X) chosen from among Dy, Ho, Er, Tm, Yb, Lu, Sr, and calcium and boron (B) in the liquid medium or the solid-state medium is started. Especially It is related with the article using the dispersing element and 6 boride particle, or this dispersing element of 6 boride particle by which the water resisting property has been improved, and this 6 boride particle.

[0002]

[Description of the Prior Art]

[0003]

[Patent reference 1] JP,2000-169765,A (claims 5-10)

[0004] Since it has the property that 6 boride particle of the permeability of the light in a light field represented with LaB6 grade is high, and is low in a reflection factor, and the permeability of the light in a near infrared region is low, it is used as a solar radiation shielding material in recent years (patent reference 1 reference).

[0005] By the way, as for the above-mentioned 6 boride particle, it is known that a front face will be decomposed with the steam and water in air. Since the surface area to the volume is increasing in existing in the state of a very fine particle especially, the phenomenon in which many [the rate of decomposing with a steam or moisture and changing to the compound of an oxide or a hydroxide / consequently] properties of 6 boride original fall gradually as for 6 boride particle front face appears.

[0006] And when it applies to an application which covers the light in a near infrared region in the paint film using 6 boride particle etc. using the optical property, the permeability of 200nm - 2600nm field rises under the effect of a steam or water, and although there was a problem on which the solar radiation electric shielding engine performance deteriorates gradually, the method of preventing this is not yet develop.

[0007]

[Problem(s) to be Solved by the Invention] This invention was made paying attention to such a trouble, and the place made into that technical problem has 6 boride particle which a water resisting property is improved and is suitably used as a solar radiation shielding material, and this 6 boride particle in offering the article using the dispersing element distributed by the liquid medium or the solid-state medium and 6 boride particle, or this dispersing element.

[0008]

[Means for Solving the Problem] Invention concerning claim 1 Namely, Y, La, Ce, Pr, Nd, Sm, It is premised on 6 boride particle of one or more kinds of elements (X) chosen from among Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Sr, and calcium. The front face of the above-mentioned 6 boride particle A silazane system processing agent, a chlorosilicane system processing agent, [whether it is physically covered with the finishing agent containing the silicon chosen from the inorganic system processing

agent which has an alkoxy group in the molecular structure, and the organic system processing agent which has an alkoxy group in a molecule end or a side chain, and] It is characterized by being covered with the above-mentioned finishing agent combined with 6 boride particle and the chemistry target on 6 boride particle front face.

[0009] Moreover, while invention concerning claim 2 carries out stirring mixing of 6 boride particle, finishing agent, and solvent before the coat by the finishing agent a premise [6 boride particle concerning invention according to claim 1], carries out distributed processing of this and obtains dispersion liquid Invention which a solvent is evaporated from dispersion liquid, is characterized by being ground and obtained after removing and carrying out stoving, and relates to claim 3 Invention which the above-mentioned 6 boride particle is characterized by being a HOU-ized lanthanum a premise [6 boride particle concerning invention according to claim 1 or 2], and relates to claim 4 Invention which the particle diameter of the above-mentioned 6 boride particle is characterized by being 10nm - 10 micrometers a premise [6 boride particle concerning invention according to claim 1 to 3], and relates to claim 5 It is premised on 6 boride particle concerning invention according to claim 1 to 4. The ratio to 6 boride particle of a finishing agent is characterized by being the 0.01 - 100 weight section to the 6 boride particle 1 weight section by the silicon conversion included in a finishing agent. Invention concerning claim 6 is characterized by constituting the article which the direct laminating of the 6 boride particle group according to claim 1 to 5 is carried out to a base material front face a premise [the article which used the above-mentioned 6 boride particle], and has the coat of 6 boride particle group.

[0010] Next, invention concerning claim 7 is premised on the dispersing element of the above-mentioned 6 boride particle. Invention which is characterized by 6 boride particle according to claim 1 to 5 distributing in a liquid medium or a solid-state medium, and relates to claim 8 It is premised on the dispersing element of 6 boride particle concerning invention according to claim 7. The above-mentioned liquid medium The description of consisting of the organic solvents or/and water which it consists of [water] an organic solvent or/and water, or dissolve or distributed either [at least] resin or a metal alkoxide is carried out. Invention concerning claim 9 is characterized by the above-mentioned solid-state medium consisting of either resin or glass a premise [the dispersing element of 6 boride particle concerning invention according to claim 7].

[0011] Moreover, invention concerning claim 10 is premised on the dispersing element of 6 boride particle concerning invention according to claim 7 or 9. Invention which the dispersing element of the above-mentioned 6 boride particle distributed in the solid-state medium is characterized by constituting the coat formed in the base material front face, and requires it for claim 11 It is premised on the dispersing element of 6 boride particle concerning invention according to claim 7 or 9. Invention which the dispersing element of the above-mentioned 6 boride particle distributed in the solid-state medium is characterized by constituting the film with a thickness of 0.1 micrometers - 50mm or the board, and requires it for claim 12 It is premised on the dispersing element of 6 boride particle concerning invention according to claim 7 or 9. Invention which is characterized by carrying out grinding processing and the dispersing element of the above-mentioned 6 boride particle distributed in the solid-state medium constituting the powdery part, and relates to claim 13 The particle diameter of the above-mentioned powdery part by which grinding processing was carried out the premise [the dispersing element of 6 boride particle concerning invention according to claim 12] Invention which is characterized by being 10nm - 10 micrometers, and relates to claim 14 is characterized by using the dispersing element of claims 10 or 11 on the assumption that the article which used the dispersing element of 6 boride particle.

[0012]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail.

[0013] Although 6 boride particle had the problem to which the front face changes to an oxide or a hydroxide with the moisture in air etc., and the property of 6 boride original falls as mentioned above When the front face of 6 boride particle is covered with the finishing agent which it is physically covered with the finishing agent, or was combined with 6 boride particle and the chemistry target on 6

boride particle front face, it has come to complete header this invention for it becoming possible to make the water resisting property of 6 boride particle improve.

[0014] Although it is the above-mentioned finishing agent as what covers 6 boride particle front face, this finishing agent may be covered with reacting to 6 boride particle front face and a chemistry target, and may be covered physically. In order that a steam and water may bar contacting 6 boride particle front face directly by coating 6 boride particle front face with the above-mentioned finishing agent as hydrophobic matter which prevents transparency of a steam, it is thought that the water resisting property of 6 boride particle improved as a result.

[0015] And as the above-mentioned finishing agent, a silazane system processing agent, a chlorosilane system processing agent, the inorganic system processing agent that has an alkoxy group in the molecular structure, and the finishing agent containing the silicon chosen from the organic system processing agent which has an alkoxy group in a molecule end or a side chain are mentioned.

[0016] It becomes possible [the above-mentioned silazane system processing agent] for reactivity with 6 boride particle to be strong, to carry out covalent bond to 6 boride particle on a particle front face, and to cover 6 boride front face. Furthermore, a silazane is oleophilic, and since the molecular structure is small, a bonnet outermost shell serves as hydrophobicity in a particle front face, and it is precisely effective in waterproof improvement. Hexamethyldisilazane, cyclic silazane, N, and N-bis (trimethylsilyl) urea, N-trimethylsilyl acetamide, dimethyl trimethyl silylamine, diethyl trimethyl silylamine, a trimethylsilyl imidazole, N-trimethylsilyl phenyl urea, etc. are mentioned, and, specifically, application of hydrolyzates, such as this, or the polymerization object of those is also possible.

[0017] Moreover, as for the above-mentioned chlorosilane system processing agent, the Krol radical forms covalent bond on 6 boride particle and a particle front face. By this, a particle front face is covered with a chlorosilane system processing agent, and its water resisting property improves. Methyltrichlorosilane, methyl dichlorosilane, dimethyldichlorosilane, trimethylchlorosilane, phenyl trichlorosilane, diphenyl dichlorosilane, truffle ROROPURO pill trichlorosilane, heptadeca FURORO decyltrichlorosilane, vinyl trichlorosilan, etc. are mentioned, and application of hydrolyzates, such as this, or the polymerization object of those is also possible for the typical thing of a chlorosilane system processing agent.

[0018] Next, as for the inorganic system processing agent which has an alkoxy group in the molecular structure, the alkoxy group forms covalent bond on 6 boride particle and a particle front face. A particle front face is covered with this by this finishing agent, and an outermost shell is covered by the lipophilic group or hydrophobic group of an inorganic system processing agent and an inorganic system processing agent, and its water resisting property improves. A silane system coupling agent etc. is mentioned as a typical thing. Specifically Vinyltriethoxysilane, a vinyl tris (beta methoxyethoxy) silane, beta-(3, 4 epoxycyclohexyl) ethyltrimethoxysilane, gamma-glycidoxy propyltrimethoxysilane, gamma-glycidoxy propyltriethoxysilane, gamma-glycidoxy propyl methyldiethoxysilane, gamma-methacryloxy propyl methyl dimethoxysilane, gamma-methacryloxypropyl triethoxysilane, N-beta(aminoethyl) gamma-aminopropyl methyl dimethoxysilane, N-beta (aminoethyl) gamma-aminopropyl trimethoxysilane, gamma-aminopropyl trimethoxysilane, gamma-aminopropyl triethoxysilane, N-phenyl gamma-aminopropyl trimethoxysilane, gamma-chloropropyl trimethoxysilane, gamma-mercapto propyltrimethoxysilane, etc. are mentioned. Furthermore, the following compounds classified as an alkoxysilane finishing agent, Namely, a tetramethoxy silane, methyl trimethoxysilane, dimethyldimethoxysilane, Phenyltrimethoxysilane, diphenyldimethoxysilane, a tetra-ethoxy silane, Methyl triethoxysilane, dimethyl diethoxysilane, phenyltriethoxysilane, Diphenyl diethoxysilane, hexyl trimethoxysilane, hexyl triethoxysilane, Decyltriethoxysilane, decyltrimethoxysilane, TORIURUORO propyltrimethoxysilane, heptadeca trifluoro decyltrimethoxysilane, etc. are mentioned, and application of hydrolyzates, such as this, or the polymerization object of those is also possible.

[0019] Moreover, it has an alkoxy group in a molecule end or a side chain, and an organic system processing [in which principal chains are oleophilic macromolecules, such as epoxy, an acrylic, and urethane] agent is also effective. Covalent bond of the alkoxy group is carried out on 6 boride particle front face, it will be covered by the outermost shell of a particle with oleophilic macromolecules, such as

epoxy, an acrylic, and urethane, and its water resisting property will improve.

[0020] Next, as an approach of making the finishing agent containing the silicon chosen as 6 boride particle front face from the silazane system processing agent, the chlorosilicane system processing agent, the inorganic system processing agent that has an alkoxy group in the molecular structure, and the organic system processing agent which has an alkoxy group in a molecule end or a side chain covering, especially the approach is not limited that 6 boride particle front face should just be covered with the above-mentioned finishing agent. For example, it may heat-treat, while spraying the solution of a finishing agent on 6 boride particle directly, and making it cover it and making it dry it, and you may cover physically or chemically.

[0021] Moreover, a wet method is mentioned as an approach of covering 6 boride particle front face with a finishing agent efficiently. This approach is the approach of making distribute 6 boride particle in a solvent suitably, adding a finishing agent in it, and covering 6 boride particle front face. The finishing agent mentioned above is efficient in a solvent, and a bonnet and waterproof 6 boride particle which improved are obtained in 6 boride particle front face. In addition, in this wet method, after evaporating a solvent, and removing from 6 boride particle and the dispersion liquid which the finishing agent distributed and carrying out stoving, the technique of grinding and covering 6 boride particle front face with a finishing agent may be taken. The coat of the finishing agent formed in 6 boride particle front face of this stoving processing compared with the approach of making it only cover in a solvent becomes precise, and moisture resistance improves. Although stoving temperature is determined by the heat-resistant temperature and the heating ambient atmosphere of 6 borides, 6 borides have desirable heat treatment of 600 degrees C or less in the ambient atmosphere in which oxygen exists, especially atmospheric air in order to oxidize from 600-degree-C order. Moreover, in the inert gas ambient atmosphere in which oxygen does not exist, although the upper limit of whenever [stoving temperature] serves as decomposition temperature of 6 borides, when it becomes 1000 degrees C or more, consistency change of the finishing agent (oxide) which has covered 6 boride particle front face decreases actually (that is, the effectiveness of the eburnation operation by heat-treatment becomes small), and the inclination for the effectiveness to a moisture-proof ** water resisting property to be saturated is shown. Therefore, as for a industrial viewpoint to the upper limit, considering as about 1000 degrees C is desirable.

[0022] And 6 boride particle covered with the finishing agent is used after the liquid medium with a particle condition or the solid-state medium has distributed as a raw material of for example, a solar radiation electric shielding product.

[0023] Here, the particle diameter of 6 boride particle is suitably set as particle diameter within the limits of 10nm - 10 micrometers by the application object used. For example, to apply to optical permselective membrane (above-mentioned film which makes the light of a light field penetrate and makes the light of a near infrared region cover), it is necessary to take dispersion by the particle into consideration. When transparency is thought as important, the particle diameter of 6 boride particle has preferably good 100nm or less 200nm or less. This reason is that the light of a 380nm - 780nm visible-ray field is scattered about, and it becomes like frosted glass, and cannot attain clear transparency by geometrical dispersion or Mie scattering if the particle diameter of a particle is large exceeding 200nm. If particle diameter is set to 200nm or less, the above-mentioned dispersion will decrease and it will become a Rayleigh-scattering field. In a Rayleigh-scattering field, since the scattered light reduces in inverse proportion to the 6th power of particle diameter, dispersion reduces it with reduction in particle diameter, and it improves [transparency]. When set to 100 morenm or less, the scattered light decreases dramatically and is desirable. However, there is also a field as which such transparency is not required depending on the application object used, and it is suitably set up within the limits of 10nm - 10 micrometers.

[0024] In addition, when performing surface treatment of the very fine particle from which particle diameter is set to 200nm or less, unfold the floc of a very fine particle in a liquid, add the above-mentioned finishing agent in the liquid which homogeneity was made to distribute, and making it act on a particle front face or unfolding in a liquid, the approach of adding the above-mentioned finishing agent

simultaneously and covering a particle front face is desirable. And as an approach of unfolding a very fine particle in a liquid, although ultrasonic irradiation, a medium agitation mill, etc. are mentioned, it is not necessarily limited to these. Furthermore, where homogeneity is distributed in a liquid, when holding 6 boride particle, distributed processing of the slurry which added the above-mentioned finishing agent may be carried out with ultrasonic irradiation, a medium agitation mill, etc. At this time, a finishing agent acts on a particle front face, and is effective also for carrying out distributed maintenance of the very fine particle into a liquid at homogeneity.

[0025] Next, where a liquid medium is distributed, when using 6 boride particle covered with the finishing agent, liquid media containing liquid media, such as organic solvents, such as alcohol, and water, or resin, a metal alkoxide, etc., such as an organic solvent and water, are mentioned as this medium. In addition, in order to obtain the dispersing element by which 6 boride particle covered with the finishing agent was distributed by the liquid medium, the approach which the method of adding and obtaining 6 boride particle covered with the finishing agent obtained by the above-mentioned wet method etc. to liquid media containing liquid media, such as organic solvents, such as alcohol, and water, or resin, a metal alkoxide, etc., such as an organic solvent and water, is mentioned, and is acquired to coat processing and coincidence may be taken. That is, the approach of obtaining the dispersing element by which liquid media, such as organic solvents, such as alcohol, and water, were made distributing 6 boride particle and the finishing agent before surface treatment, and 6 boride particle covered with the finishing agent by coat processing and coincidence was distributed may be adopted.

[0026] Moreover, when it is applied as it is, for example, constitutes a solar radiation electric shielding product etc., the above-mentioned 6 boride particle covered with the finishing agent constitutes a solar radiation electric shielding product etc., after solid-state media, such as resin or glass, have distributed, or it is ground, and may constitute the raw material for solar radiation electric shielding products.

[0027] After applying suitably to a base material front face the dispersing element which, for example, made liquid media, such as organic solvents, such as alcohol, and water, distribute 6 boride particle covered with the finishing agent as it is as a case of the former, liquid media, such as the above-mentioned organic solvent and water, are heat-treated and removed, and the solar radiation electric shielding product with which the direct laminating of the 6 boride particle group covered with the finishing agent was carried out to the base material front face is illustrated. In addition, 6 boride particle such whose utilization is attained is the case where the finishing agent applied possesses a heat adhesive property to a base material independently. Therefore, when the adhesive strength of a finishing agent is weak, after making a base material front face carry out the laminating of the 6 boride particle group, the coating liquid containing binder components, such as resin, may be applied, and the solar radiation electric shielding product which removed the solvent component in coating liquid and carried out the resin coat may be obtained.

[0028] As a case of the latter, on the other hand, 6 boride particle covered with the finishing agent While applying suitably the dispersing element which liquid media containing resin, a metal alkoxide, etc., such as an organic solvent and water, were made to distribute on the surface of a base material and evaporating solvents, such as an organic solvent and water 6 boride particle can produce easily the dispersing element (the resin or the glass coat with which 6 boride particle covered with the finishing agent was distributed) distributed to the solid-state medium by stiffening a resin metallurgy group alkoxide etc. In addition, as a resinous principle, according to an application, it is selectable and ultraviolet-rays hardening resin, heat-curing resin, room-temperature-setting resin, thermoplastic resin, etc. are mentioned. Moreover, when the dispersing element to which the liquid medium which does not contain components, such as resin, was applied is used, after making a base material front face carry out the laminating of the 6 boride particle group, even if it applied the liquid medium containing components, such as resin, as it mentioned above, the same dispersing element can be obtained.

[0029] Here, the film which 6 boride particle covered with the finishing agent distributed in the solid-state medium may be heat-treated, and its moisture resistance improves by heat-treating. When 6 boride particle which has not performed prior heat treatment about a finishing agent especially is applied, the coat of a finishing agent becomes precise by this heat treatment, and moisture resistance improves

further. And in the ambient atmosphere in which oxygen exists, especially atmospheric air, although having mentioned whenever [stoving temperature] above is determined according to the heat-resistant temperature and the heating ambient atmosphere of 6 borides, heat treatment of 600 degrees C or less is desirable [6 borides] in order to oxidize from 600-degree-C order. Moreover, although the upper limit of whenever [stoving temperature] serves as decomposition temperature of 6 borides in the inert gas ambient atmosphere in which oxygen does not exist, consistency change of the coat (oxide) which will have been covered if it becomes 1000 degrees C or more decreases, and the effectiveness to a moisture-proof ** water resisting property is saturated. Therefore, as for a industrial viewpoint to an upper limit, considering as 1000 degrees C is desirable.

[0030] moreover, 6 boride particle covered with the finishing agent about the dispersing element distributed by liquid media containing resin, a metal alkoxide, etc., such as an organic solvent and water. As mentioned above, may apply to a base material front face suitably, may form a coat, may use as a solar radiation electric shielding product etc., and About the dispersing element distributed by liquid media containing resin, a metal alkoxide, etc., such as an organic solvent and water, while 6 boride particle covered with the finishing agent dries and heat-treats this, it may carry out grinding processing and may apply as powder-like a raw material for solar radiation electric shielding products. That is, about the dispersing element of the shape of powder by which 6 boride particle was distributed by the solid-state medium, again, it may be made to distribute in a liquid medium and this may be used as dispersion liquid for solar radiation electric shielding products, and into resin, it scours and you may use it so that it may mention later. In addition, it is suitably set as particle diameter within the limits of 10nm - 10 micrometers by the application object used also about the particle size of the above-mentioned dispersing element of the shape of powder by which grinding processing was carried out.

[0031] Moreover, the dispersing element which 6 boride particle distributed to the solid-state medium may be a gestalt which constitutes a film with a thickness [the dispersing element of 6 boride particle which exists in the base material front face mentioned above by the shape of film, or not only a powder-like dispersing element but] of 0.1 micrometers - 50mm, or a board. And it is possible to scour the above-mentioned 6 boride particle which has the particle diameter which was covered with the finishing agent and suited the object to direct resin, when scouring to resin and fabricating on a film or a board. Moreover, it is also possible to also mix the dispersing element which the above-mentioned 6 boride particle distributed to the liquid medium, and resin, or to add the dispersing element of the shape of powder by which 6 boride particle was distributed by the solid-state medium to a liquid medium, and to mix with resin. Generally, when scouring to resin, heating mixing is carried out at the temperature near the melting point of resin (before or after 200-300 degrees C). Furthermore, it is possible to pelletize after mixing to resin and to form a film and a board by the all directions formula. For example, it can form by the extrusion-molding method, the inflation-molding method, the solution casting method, the casting method, etc. Although the amount of fillers to resin (namely, loadings of 6 boride particle) is adjustable according to the thickness of a base material, or the optical property and mechanical characteristic which are needed, generally 50 or less % of the weight is [that what is necessary is just to set up the film at this time, and the thickness of a board suitably therefore in activity eye] desirable [the amount] to resin.

[0032] Moreover, its fluororesin is effective if weatherability is taken into consideration according to an application by not being limited, although especially the resin used as the parent of a film or a board is selectable. Furthermore, compared with a fluororesin, PET, acrylic resin, polyamide resin, vinyl chloride resin, polycarbonate resin, olefine resin, an epoxy resin, polyimide resin, etc. are mentioned as large resin of versatility with high transparency by low cost.

[0033] next, although the addition (namely, ratio) to 6 boride particle of the above-mentioned finishing agent is arbitrary as a principle, it is the 0.01 - 100 weight section to the 6 boride particle 1 weight section in the silicon conversion included in a finishing agent if -- it is desirable. When the effectiveness which covers a front face in case of under the 0.01 weight section may be small, and the effectiveness of waterproof improvement may not be enough and the 100 weight sections are exceeded, the waterproof improvement by surface coating is not found, but it is because covering effect may be small.

[0034] And Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, When a light filter is constituted with the application of 6 boride particle of one or more kinds of elements (X) chosen from among Ho, Er, Tm, Yb, Lu, Sr, and calcium () That is, when the article using the dispersing element concerning this invention is a light filter, reflective absorption is carried out, the light near 1000nm is covered, and it becomes possible to make the property which penetrates 380nm - 780nm light provide. Since such a property originates in the electronic structure peculiar to 6 borides and has the plasmon resonance of a free electron near 1000nm especially, it carries out the absorption echo of the light of this field at broadcloth.

[0035] Furthermore, since there is little absorption of a 380nm - 780nm light field, it is suitable not only for the application of the above-mentioned light filter but other applications which penetrate a visible-ray field and cover a near infrared ray. For example, as an article using 6 boride particle concerning this invention, or its dispersing element, if it applies to the aperture material of a residence or an automobile, a greenhouse, etc., the near infrared ray near 1000nm of sunrays is covered, and it has the advantage from which visibility is secured at the same time high adiabatic efficiency is acquired.

[0036] In addition, the amount of 6 boride particle used to articles, such as the above-mentioned light filter and aperture material, can be suitably changed with the property searched for. And in the case 6 of the light filter for heat insulation which penetrates a visible-ray field and covers a near infrared ray, for example, LaB, the adiabatic efficiency at 0.01g or more with the amount of fillers effective 1m per two is acquired. Although an upper limit is based also on the optical property for which it asks, it is possible in carrying out absorption electric shielding of the heat energy of about 50% of sunrays by 0.1g per two 1m, and is high. [of the adiabatic efficiency in a unit weight]

[0037]

[Example] Hereafter, although the example of this invention is explained concretely, this invention is not necessarily limited to the following examples.

[0038] Moreover, the light permeability in an example is the integrated value of the amount of transmitted lights which standardized the amount of transparency of the light of a field with a wavelength of 380nm - 780nm with the visibility of people's eyes, and is a value meaning the brightness which people's eyes sense. At the following examples, it is JISA. It is measuring by the approach according to 5759 (however, it does not stick on glass but is measuring only with the film).

[0039] Moreover, the membranous haze value performed measurement based on JIS K.7105. measuring device [for which mean-dispersion particle diameter used dynamic light scattering -- it considered as the average measured by ELS[by Otsuka electronic incorporated company]-800].

[0040] Moreover, when the waterproof assessment approach was left for four days by the environment of 90% of humidity at 60 degrees C, in the sample of 68% - 75% of light permeability, lifting of permeability made the thing of five or less points good, and the water resisting property made the thing exceeding five points the defect.

[0041] Stirring mixing of [example 1] 6 HOU-ized lanthanum 20g, gamma-glycidoxy propyltriethoxysilane 8g which is a silane coupling agent, and the toluene 72g was carried out, distributed processing of this was carried out with the medium agitation mill, and dispersion liquid with a mean-dispersion particle diameter of 100nm were prepared.

[0042] Ultraviolet-rays hardening resin UV3701[Toagosei 5] g was mixed with 2g of this liquid, and it considered as coating liquid. The PET film of 50-micrometer thickness was used for the base material, and the above-mentioned coating liquid was formed on the PET film using the bar coating machine. After drying this for 1 minute at 70 degrees C and evaporating a solvent, ultraviolet rays were irradiated using the high-pressure mercury lamp, and the film was stiffened. The light permeability of the film at this time was 70%, and the haze was 0.9%.

[0043] When light permeability was measured for this after neglect for four days by the environment of 90% of humidity at 60 degrees C, lifting of permeability of light permeability was 1.3 points at 71.3%, and the water resisting property of a coat was good.

[0044] Stirring mixing of [example 1 of comparison] 6 HOU-ized lanthanum 20g and the toluene 80g was carried out, distributed processing of this was carried out, and dispersion liquid with a mean-

dispersion particle diameter of 300nm were produced. Ultraviolet-rays hardening resin UV3701 [Toagosei 5] g was mixed with 2g of this liquid, and it considered as coating liquid.

[0045] The PET film of 50-micrometer thickness was used for the base material, and coating liquid was formed on the PET film using the bar coating machine. After drying this for 1 minute at 70 degrees C and evaporating a solvent, ultraviolet rays were irradiated using the high-pressure mercury lamp, and the film was stiffened. The light permeability of the film at this time was 69.2%, and the haze was 2.5%.

[0046] When light permeability was measured for this after neglect for four days by the environment of 90% of humidity at 60 degrees C, lifting of permeability of light permeability was 6.4 points at 75.6%, and the water resisting property of a coat was poor.

[0047] Stirring mixing of [example 2] 6 hoe-ized cerium 20g, hexamethyldisilazane 8g, and the toluene 72g was carried out, distributed processing of this was carried out, and dispersion liquid with a mean-dispersion particle diameter of 100nm were prepared.

[0048] Ultraviolet-rays hardening resin UV3701 [Toagosei 5] g was mixed with 2g of this liquid, and it considered as coating liquid.

[0049] The PET film of 50-micrometer thickness was used for the base material, and coating liquid was formed on the PET film using the bar coating machine. After drying this for 1 minute at 70 degrees C and evaporating a solvent, ultraviolet rays were irradiated using the high-pressure mercury lamp, and the film was stiffened. The light permeability of the film at this time was 71.7%, and the haze was 1.0%.

[0050] When light permeability was measured for this after neglect for four days by the environment of 90% of humidity at 60 degrees C, lifting of permeability of light permeability was 1.2 points at 72.9%, and the water resisting property of a coat was good.

[0051] Stirring mixing of [example 3] 6 hoe-ized lanthanum 10g, methyl trimetoxysilane 45g, ethanol 25g, and the 20g of the water was carried out, distributed processing of this was carried out, and dispersion liquid with a mean-dispersion particle diameter of 100nm were prepared.

[0052] Ultraviolet-rays hardening resin UV3701 [Toagosei 4] g was mixed with 3g of this liquid, and it considered as coating liquid.

[0053] The PET film of 50-micrometer thickness was used for the base material, and coating liquid was formed on the PET film using the bar coating machine. After drying this for 1 minute at 70 degrees C and evaporating a solvent, ultraviolet rays were irradiated using the high-pressure mercury lamp, and the film was stiffened. The light permeability of the film at this time was 72.0%, and the haze was 0.9%.

[0054] When light permeability was measured for this after neglect for four days by the environment of 90% of humidity at 60 degrees C, lifting of permeability of light permeability was 0.5 points at 72.5%, and the water resisting property of a coat was good.

[0055] Stirring mixing of [example 4] 6 hoe-ized lanthanum 20g, methyl trimetoxysilane 8.2g, ethanol 51.8g, and the 20g of the water was carried out, distributed processing of this was carried out, and dispersion liquid with a mean-dispersion particle diameter of 100nm were prepared.

[0056] Ultraviolet-rays hardening resin UV3701 [Toagosei 4] g was mixed with 3g of this liquid, and it considered as coating liquid.

[0057] The PET film of 50-micrometer thickness was used for the base material, and coating liquid was formed on the PET film using the bar coating machine. After drying this for 1 minute at 70 degrees C and evaporating a solvent, ultraviolet rays were irradiated using the high-pressure mercury lamp, and the film was stiffened. The light permeability of the film at this time was 68.0%, and the haze was 0.9%.

[0058] When light permeability was measured for this after neglect for four days by the environment of 90% of humidity at 60 degrees C, lifting of permeability of light permeability was 0.5 points at 68.5%, and the water resisting property of a coat was good.

[0059] Stirring mixing of [example 5] 6 hoe-ized lanthanum 20g, methyl trimetoxysilane 8.2g, ethanol 51.8g, and the 20g of the water was carried out, distributed processing of this was carried out, and dispersion liquid with a mean-dispersion particle diameter of 100nm were prepared.

[0060] After carrying out the vacuum drying of these dispersion liquid and evaporating a solvent, it heat-treated at 400 degrees C for 2 hours, and powder was obtained. Dry grinding of this powder was carried out, and the powdery part with a mean particle diameter of about 1-2 micrometers was obtained.

[0061] 20g and 8g of organic dispersants and toluene 72g were mixed for this powdery part, distributed processing was performed, and dispersion liquid with a mean-dispersion particle diameter of 100nm were adjusted.

[0062] Ultraviolet-rays hardening resin UV3701[Toagosei 4] g was mixed with 3g of this liquid, and it considered as coating liquid.

[0063] The PET film of 50-micrometer thickness was used for the base material, and coating liquid was formed on the PET film using the bar coating machine. After drying this for 1 minute at 70 degrees C and evaporating a solvent, ultraviolet rays were irradiated using the high-pressure mercury lamp, and the film was stiffened. The light permeability of the film at this time was 72.1%, and the haze was 0.9%.

[0064] When light permeability was measured for this after neglect for four days by the environment of 90% of humidity at 60 degrees C, lifting of permeability of light permeability was 0.1 points at 72.2%, and the water resisting property of a coat was good.

[0065] Stirring mixing of [example 6] 6 hoe-ized lanthanum 20g, methyl trimetoxysilane 8.2g, ethanol 51.8g, and the 20g of the water was carried out, distributed processing of this was carried out, and dispersion liquid with a mean-dispersion particle diameter of 100nm were prepared.

[0066] After carrying out the vacuum drying of these dispersion liquid and evaporating a solvent, it heat-treated at 200 degrees C for 2 hours, and powder was obtained. Dry grinding of this powder was carried out, and the powdery part with a mean particle diameter of about 1-2 micrometers was obtained.

[0067] 20g and 8g of organic dispersants and toluene 72g were mixed for this powdery part, distributed processing was performed, and dispersion liquid with a mean-dispersion particle diameter of 100nm were adjusted.

[0068] Ultraviolet-rays hardening resin UV3701[Toagosei 4] g was mixed with 3g of this liquid, and it considered as coating liquid.

[0069] The PET film of 50-micrometer thickness was used for the base material, and coating liquid was formed on the PET film using the bar coating machine. After drying this for 1 minute at 70 degrees C and evaporating a solvent, ultraviolet rays were irradiated using the high-pressure mercury lamp, and the film was stiffened. The light permeability of the film at this time was 71.1%, and the haze was 0.9%.

[0070] When light permeability was measured for this after neglect for four days by the environment of 90% of humidity at 60 degrees C, lifting of permeability of light permeability was 0.3 points at 71.4%, and the water resisting property of a coat was good.

[0071] Stirring mixing of [example 7] 6 hoe-ized lanthanum 20g, methyl trimetoxysilane 8.2g, ethanol 51.8g, and the 20g of the water was carried out, distributed processing of this was carried out, and dispersion liquid with a mean-dispersion particle diameter of 100nm were prepared.

[0072] After carrying out the vacuum drying of these dispersion liquid and evaporating a solvent, it heat-treated at 400 degrees C for 2 hours, and powder was obtained. Dry grinding of this powder was carried out, and the powdery part with a mean particle diameter of about 1-2 micrometers was obtained. Wet grinding of the obtained powdery part was carried out further, and it considered as the mean particle diameter of about 300nm, and the solvent was evaporated and it considered as the powdery part.

[0073] Sealing mixing was fully performed at 320 degrees C which is near the melting temperature of after dry blending and resin in V blender in 0.01kg of this powdery part, and 8.7kg of ETFE (tetrafluoroethylene-ethylene copolymer) resin, and this mixture was extruded at 320 degrees C, and was fabricated on about 50-micrometer film. The light permeability at this time was 71.8%, and the haze was 9.8%.

[0074] When light permeability was measured for this after neglect for four days by the environment of 90% of humidity at 60 degrees C, lifting of permeability of light permeability was zero point at 71.8%, and the water resisting property of a film was very good.

[0075] Stirring mixing of [example 8] 6 hoe-ized lanthanum 20g, methyl trimetoxysilane 8.2g, ethanol 51.8g, and the 20g of the water was carried out, distributed processing of this was carried out, and dispersion liquid with a mean-dispersion particle diameter of 100nm were prepared.

[0076] After carrying out the vacuum drying of these dispersion liquid and evaporating a solvent, it heat-treated at 400 degrees C for 2 hours, and powder was obtained. Dry grinding of this powder was

carried out, and the powdery part with a mean particle diameter of about 1-2 micrometers was obtained. Wet grinding of the obtained powdery part was carried out further, and it considered as the mean particle diameter of about 150nm, and the solvent was evaporated and it considered as the powdery part.

[0077] Sealing mixing was fully performed at 300 degrees C which is near the melting temperature of after dry blending and resin in V blender about this 0.01kg of powdery parts and 8.7kg of PET, and this mixture was extruded at 300 degrees C, and was fabricated on about 50-micrometer film. The light permeability at this time was 70.0%, and the haze was 1.2%.

[0078] When light permeability was measured for this after neglect for four days by the environment of 90% of humidity at 60 degrees C, lifting of permeability of light permeability was zero point at 70.0%, and the water resisting property of a film was very good.

[0079] 20g and toluene 80g were mixed for the [example 2 of comparison] 6 HOU-ized lanthanum, distributed processing was performed, and dispersion liquid with a mean-dispersion particle diameter of 320nm were prepared.

[0080] These dispersion liquid were removed at 50 degrees C, the vacuum dryer removed the solvent component, and it considered as powder. Sealing mixing was fully performed at 320 degrees C which is near the melting temperature of after dry blending and resin in V blender in 0.01kg of this powder, and 8.7kg of ETFE (tetrafluoroethylene-ethylene copolymer) resin, and this mixture was extruded at 320 degrees C, and was fabricated on about 50-micrometer film. The haze of the light permeability at this time was 14.8% at 69.9%.

[0081] When light permeability was measured for this after neglect for four days by the environment of 90% of humidity at 60 degrees C, lifting of permeability of light permeability was 5.2 points at 75.1%, and the water resisting property of a film was poor.

[0082]

[Effect of the Invention] The dispersing element concerning invention according to claim 7 to 13 by which 6 boride particle concerning invention according to claim 1 to 5 and this 6 boride particle were distributed, And according to the article concerning invention according to claim 6 or 14 using 6 boride particle or a dispersing element The front face of 6 boride particle A silazane system processing agent, a chlorosilicane system processing agent, [whether it is physically covered with the finishing agent containing the silicon chosen from the inorganic system processing agent which has an alkoxy group in the molecular structure, and the organic system processing agent which has an alkoxy group in a molecule end or a side chain, and] Since it is covered with the above-mentioned finishing agent combined with 6 boride particle and the chemistry target on 6 boride particle front face, It becomes possible to raise the water resisting property of 6 boride particle, and has the effectiveness that articles, such as 6 boride particle excellent in the water resisting property, its dispersing element, a film, and a board, can be offered.

[Translation done.]